Multichannel asymptotic model
for the study of cold-atom interactions

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Precise knowledge of cold-atom collision properties is essential for the studies of cold molecule formation or Bose-Einstein condensation. In such experiments, the interaction mainly occurs at rather large interatomic distance, in the so-called asymptotic region. We have developed a purely asymptotic method which allows us to fully describe the collision properties without using the inner part of the molecular potentials, which is often known with a poor precision. The key point of the method is the lines connecting the nodes of successive wavefunctions. Computing such nodal lines, by numerical integration in the asymptotic region only, provides a very simple way to derive scattering lengths from observed bound level positions [1]. The method has been extended to the multichannel case and appears now as a genuine parametric method, in which a few parameters (some chosen nodal lines) replace the inner part of the potentials. These nodal lines are used as fitting parameters, which are adjusted on experimental results. Any collision property such as scattering lengths, clock shifts or magnetic field induced Feshbach resonances can be obtained in principle once these parameters have been determined. Applications of the method to the case of sodium and cesium will be described.